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The MONTHLY REVIEW

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OF THE

SCIENCE OF ELECTROPLATING

DECEMBER, 1925

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THIRTEENTH ANNUAL BANQUET

ST. LOUIS BRANCH, A. E. S.

SATURDAY, JANUARY 16, 1926

American Annex

Educational Session in the afternoon with George B. Hogaboom and A. P. Munning, Jr. as principal speakers.

MOVIE PARTY FOR THE LADIES

Banquet 6:15—Dancing 8:15

The Committee

MONTHLY REVIEW

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VOL. XII DECEMBER, 1925 No. 12

EDITORIAL

ATTENTION, MEMBERS

Your personal assistance is necessary to make a success of our effort to raise a research fund. Two letters have been sent to over 1,600 manufacturers asking them to contribute and to date we have only received less than 10% of the desired amount. This does not mean that the plan fails to meet with favor, but manufacturers are like individuals; when they receive a letter asking for a subscription for any cause, they lay it aside for the present, even though agreeing that it is worthy and deserving of their support and wait until they are solicited personally for their subscription.

Now, fellows, your employer will think a whole lot more of you if you will show an interest in this undertaking and come right out and ask him if he will subscribe $50.00 per year for a period of three years.

There are lots of good business reasons for him assisting in this research work, and most of you will be surprised at the friendly attitude of your employer toward this research work. A good many employers will make a seemingly good excuse for not subscribing, but here is where you can get some more admiration from your boss if you will still try to show and urge him to subscribe.

Wherever possible you should try to explain where this research work might benefit your particular concern. Care must be taken, however, that no misrepresentations are made as to the immediate results to be obtained, as research work is necessarily comparatively slow and the

value of its accomplishments are not always apparent at first.

During January you will be asked by your Research Committee to do your share, and I have assured them that you would. Remember, fellows, that the A. E. S. have broadcasted to over 1,600 manufacturers directly, and to many others through the trade journals that we are going to do something, and we cannot afford to fail in the attempt. We are on trial and we can acquit ourselves with prestige for our Society if we succeed.

Are we going to **SUCCEED? IT IS UP TO YOU PERSONALLY.**

E. J. MUSICK,
Supreme President.

MEMBERSHIP DRIVE ENDS MARCH 1

It has been decided to extend the membership drive to March 1, 1926, in order to permit all branches to clean up their district and make it as near 100% A. E. S. as possible.

Many branches are having their annual banquets, smokers and open meetings during January and February and they should avail themselves of the opportunity to add quite a few members to their roster at these functions.

The past 60 days have just been "a warm-up" for most of our branches, according to their own statements, and as they claim that they could have done better if they had more time, I am going to see if they will make good.

I sincerely urge that each and every branch will start the new year with a determination to go over the top on their quota of new members. You can do it; your branch is no exception. Signed applications are the kind of answers for which I appeal to you.

Yours very truly,
E. J. MUSICK,
Supreme President.

NEW YORK BRANCH
FOUNDERS' DAY AND BANQUET
FEB. 20, 1926
Keep this date open

HYDROGEN PITTING IN NICKEL PLATED DEPOSITS ITS CAUSE AND CURE

By Charles H. Proctor

Electro-nickel platers who can look backwards thirty years or more, when the industry was in its infancy, will tell you that they had no pitting of nickel deposits in those years. Their fathers from whom many of the present old-time platers learned the art of plating, never mentioned pitting, so in those earlier years in the nickel plating industry we can readily believe that pitting was an unknown quantity. Yet nickel cannot be deposited successfully without hydrogen, so presumably there was pitting to some extent, but of such minutesness that it never became a detriment under the then existing conditions of nickel plating. There was another hydrogen condition that I met in the late eighties, between 1888 and 1890 that caused me endless trouble in the nickel plating of very highly polished copper sheets (dimensions, 22x54 inches, 1-16″ thick, plated and polished on both sides and used in the celluloid industry). I have only within the past few months discovered the true cause of my difficulties during those years which showed up in many instances when the nickel plated sheets were placed under hydraulic pressure at temperatures exceeding 300° F., with the celluloid mass between them to produce polished celluloid sheet of great lustre and uniformity of size and thickness. Due to the heat and pressure, it was frequently found, upon the removal of the sheets of celluloid when cool, that the nickel deposit had entirely separated from the copper sheet and had become imbedded in the celluloid sheets. You can realize the financial loss that was entailed, because both the celluloid and the nickel plated copper sheets became valueless. It was impossible to notice the non-adherence of the nickel plated deposit before the sheets were shipped from our point of manufacture, Ansonia, Conn. Trimming of the sheets with shears bending and final polishing with 24-inch buffs, 56-inch surface did not affect the nickel deposit, so you can realize the nervous tension I was under after each great shipment of sheets had been made and until they had finally been reported by the purchaser.

If I had known as much about hydrogen then as I do now, I could have eliminated my troubles in a matter of minutes. I know now that it was hydrogen that caused all the trouble of nickel separation from the polished copper surface. I have proved it, but we still continue to meet this same trouble at times. I have designated the condition as the "hydrogen blanket." In other words, condition of the nickel plating solution, which results in a blanket of nascent hydrogen upon the metal surface (generally copper, high-carbon steel or mild, low-carbon steel), which acts as a preventive of the true adhesion of the nickel to the base metal, although the nickel deposit may otherwise be malleable.

This hydrogen blanket has caused more cleaning problems to be laid at the door of the manufacturer of alkaline cleaning compounds used in the plating industry than all of other causes combined. He has been made the innocent victim of many unjust complaints, but the factor that I shall mention later will remove his shackles and make him a free man so far as hydrogen and its problems are concerned in the production of nickel plated products.

I have talked with many old-time platers who were still young men in the eighties, and they all concede that in those years, when solutions were prepared from double nickel salts and boracic acid, with an occasional addition of sodium or ammonium chloride as a conducting factor, pitting was an unknown quantity.

My difficulties in nickel plating copper sheets, previously referred to, were controlled to a great extent by adding pure ammonium sulphate and citric acid in small quantities to a nickel solution originally prepared with double nickel salts only. These factors, outside of water, were the only additions made to the nickel solution used in plating the copper sheets. As a rule in plating all other products made of brass, bronze, steel and cast iron, during the age known as the kerosene oil lamp age, I had practically no trouble with pitting or peeling. It was only on large, absolutely plain surfaces that I had difficulty. The ammonium sulphate presumably controlled hydrogen deposition to a great extent.

A recent patent was granted to a well-known chemical

firm covering the addition for hydrogen control to a cadmium solution of the cyanide twpe of ammonium sulphate, so we can again say that there is nothing new under the sun. The modern hydrogen pitting of nickel deposits which has caused endless amount of trouble in the automobile accessory and other industries had its origin with the introduction of the single nickel salt solution, the resultant high metal content in the solution and high current densities. It was at first presumed that the heating of the concentrated nickel solutions to 120° F. and upwards would liberate the hydrogen from the nickel solution by the expansion of the hydrogen bubble, which would burst it. Heating of the solution did help somewhat. The filtering of the nickel solution continuously during the plating operation was advised to overcome the trouble in many instances. However, filtering of the solution resulted in more pitting instead of less. The author has failed so far to find in any authentic work on electroplating written during the interim between the years of 1880 and the present any satisfactory explanation of the cause of hydrogen pitting and its cure. The primary cause in these works have always mentioned dust or some organic factor adhering to the surface of the metal. Air has been mentioned many times as a primary cause.

Our esteemed friend and co-worker, Dr. Oliver P. Watts, of the University of Wisconsin, in his excellent address on "Pitting of Nickel Plating," at the annual banquet of the Chicago Branch of the American Electroplaters' Society, in January, 1924, sums up the causes of nickel pitting from the reports of those members of the Society who were so kind as to write their experiences with pitting as follows:

(a) The solution is too acid
(b) It is too alkaline
(c) The current density is too high
(d) Imperfections on the metal surface

Dr. Watts frankly admitted at the outset of his address, "Although I have used in experimenting all the time that I could beg, borrow or steal, I am still unable to give you a cure for pitting." F. E. Halbert in his excellent article entitled, "The Pitting of Nickel Deposits," published

in the Brass World, page 336, October, 1907, gives the most satisfactory explanation of the causes of hydrogen pitting, but could offer no solution of the problem. This article was answered in the same periodical in November, 1907, by a comment by an author who signed himself the Standard Plating Works, York, Pa. He mentioned as a cure the addition of 4 pounds of salammoniac and one pound of boric acid to every hundred gallons of solution. If the solution still pits after a few days, then add one pound more salammoniac and four ounces of boracic acid. He further stated that the nickel solution should have been made from double nickel salts in the usual manner. There is no question but that this suggestion did help, to a great extent, the minor pitting that developed in a double nickel salt solution. These factors, however, are a part of all single nickel salt solutions, the chlorine factor being in one compound or another now advocated by various authors.

The late Emanuel Blassett wrote an excellent article on "The Cause and Prevention of Pitted and Rough Nickel Deposits" in the Metal Industry, December, 1911, pages 462-463. Mr. Blassett, however, did not solve the problem of pitting in his article. Thomas Edison was the first to solve the problem of hydrogen control of nickel plated deposits. He had found the very detrimental influence of hydrogen deposition when endeavoring to produce a perfectly malleable nickel deposit. He obtained a patent, U. S. No. 964,096, in 1910, covering the introduction of chlorine gas into the nickel solution. The function of the chlorine was to combine with the hydrogen and form hydrochloric acid. The free acid so formed in solution removed the excessive amounts of hydrogen and became a factor in increased anode reduction and greater solution conductivity. The value of Edison's ideas have been amply proven during the past five years by the commercial use of nickel chloride ($NiCl_2$) on a very extensive scale in rapid nickel deposition, which has proved to be more or less of a hydrogen controlling factor.

It was Edison's theory of the value of chlorine that gave the writer the cue a few years ago to advocate extensively the use of nickel chloride. It has proved its value and many a bad case of pitting has been controlled by its use.

In one of the very large automobile plating departments in the Middle West, pitting and peeling of nickel plated radiator shells have been entirely eliminated by replenishing the hot nickel solutions operated, with 2 parts single nickel salts and 1 part nickel chloride, or in some extreme cases equal parts of the factors mentioned.

Nickel chloride cannot, however, be considered the real factor in the control of hydrogen pitting or the hydrogen blanket condition, to which I have referred. Hydrogen peroxide prepared from sodium perborate is the factor that will always control hydrogen pitting. This has been proved in a hundred plating plants during the past year and a half and has eliminated a great source of trouble to the plater and a costly disturber in the plating industry. It is now possible to use solutions advocated by Watts and others of high metal concentration and current densities of 100 amperes per square foot of surface in heated nickel solutions and obtain adherent malleable non-pitted nickel deposits.

The section of an automobile bumper, in the illustration, made of high carbon nickel steel shows the most remarkable case of hydrogen pitting ever seen. The bumper was plated in a solution consisting of: Water, 1 gallon; single nickel salts, 32 ounces; nickel chloride, 3 ounces; boric acid, 2 ounces; amperage, 100 per square foot of surface area; voltage, 5; temperature of solution 120 F.; anodes cast nickel, 95-97 per cent; continuous filtered solution. Cadmium metal had been added to this solution as a brightening factor. Under lower current densities, bright nickel plated bumpers were plated that required no final polishing. Such bumpers finally nickel plated for 45 minutes at 50 amperes or less have stood up under the 20 per cent salt spray test for 300 hours continuous spraying. At the high current densities mentioned, the sample section of bumper shows the remarkable hydrogen pitting. Part of the bumper is polished; the other part unpolished as it came from the nickel solution. It required 7½ grams of sodium perborate per gallon of solution to eliminate the pitting and produce a splendid nickel deposit, free from hydrogen pitting at a current density of 100 amperes per square foot of metal surface area.

I have cured hydrogen pitting and peeling due to hy-

drogen blanket layer many, many times with additions of from 2 grains (1-15 oz.) per gallon of nickel solution to 7½ grams per gallon, or a little more than ¼ oz. The solutions so treated have run from 1,000 gallons down to two or three gallons.

The formula given in my article in collaboration with Oliver Sizelove in the August, 1925, issue of the American Electroplaters' Monthly Review and the Metal Industry for November, 1925, developed a bad case of hydrogen blanket upon mild sheet steel. The deposits of nickel 1/1000° thick on each side of the sheet of steel plate, showed very little pitting, and was malleable and ductile. But, due to the hydrogen blanket, the nickel peeled entirely when the steel was bent at an angle of 45 degrees. The acidity of the solution was increased above the normal pH 5.4 and 2 grams of sodium perborate per gallon of solution entirely eliminated the hydrogen blanket condition, and resulted in a perfectly adherent, non-porous nickel deposit at 50 amperes per square foot of surface at a normal temperature.

The formula of the nickel solution referred to consists of the following materials:

Water	1 gallon
Single nickel salts	32 ozs.
Cobalt chloride	4 ozs.
Magnesium sulphate	16 ozs.
Boric acid	2 ozs.
75% acetic acid	½ oz.

This solution was operated at normal temperature, at 4 to 5 volts and 50 amperes per square foot of surface area. After operating the solution for 24 hours the hydrogen blanket was discovered by reason of the fact that the nickel entirely separated from both sides of the mild sheet steel. The acidity of the solution was then increased by a further addition of ½ fluid oz. of 75 per cent acetic acid and 2 grams (1-15 oz.) of sodium perborate per gallon of solution, stirred thoroughly into the solution. The free acid and the sodium perborate resulted in the formation of hydrogen peroxide, the hydrogen peroxide, the hydrogen eliminating factor.

"Use of Sodium Perborate to Control Hydrogen and Hydrogen Pitting in Nickel Plating Solutions"

It was Dr. Madsen who first proposed publicly the use of hydrogen peroxide as a controlling factor for hydrogen in nickel plating solutions. He advocated from 4 to 16 cc of a 3% solution per gallon of solution, or 1 to 4 cc per litre.

The active oxygen contained in and splitting off the hydrogen peroxide combines with the hydrogen as it is generated at the cathode, and thus prevents the well-known hydrogen pitting.

Hydrogen peroxide is an unstable liquid which starts to decompose as soon as it is made. Moreover, it contains only 1-1½% oxygen, the rest being water. It is therefore bulky and causes a great deal of expense in transportation.

It was to overcome these disadvantages that I cast about to find a better source of oxygen which would be relied upon to retain its valuable oxygen until required, which would not necessitate carrying around an enormous bulk of dead matter, and which would permit accurate measurement and therefore uniform results. If, besides this, such a chemical were slightly alkaline, its addition to the acid nickel solution would neutralize a part of the acid.

I found such a chemical in sodium perborate ($Na\ Bo_3 + 4\ H_2O$), which is a powder containing 10 per cent available oxygen. Its solution in water is mildly alkaline. It can be kept indefinitely without loss of strength. One pound is the equivalent of 6.7 lbs. hydrogen peroxide. It costs one-third less for the oxygen it contains. Instead of from 8.8 to 35 pounds of hydrogen peroxide per 1,000 gallons of nickel solution, we take from 1 1-3 to 5 pounds of sodium perborate. The perborate should first be dissolved in warm water (100 degrees F.) at the rate of 1 pound in 6 gallons. This solution is then added to the nickel bath in such quantity as experience teaches will take care of the hydrogen evolved.

In most instances the slight alkalinity of the perborate solution is of advantage in cutting down excessive acidity of the nickel bath, but when the latter is finely regulated the perborate solution may first be acidified with hydrochloric acid until it equals the acidity of the nickel bath.

I may state that in every case I have met, the perborate

has acted as expected, and has prevented hydrogen pitting, which would appear to indicate that sodium perborate accomplishes all that hydrogen peroxide does, but overcomes its disadvantages and is cheaper.

INSOLUBLE MATTER IN THE NICKEL BATH AND ITS EFFECT UPON THE PROTECTIVE VALUE OF THE PLATE APPLIED

F. R. Porter and E. F. Sward, Edison Electric Appliance Company

In standardizing plating conditions, developing control methods for solutions and tests for finished plate in this plant, it has been our experience that a large part of the plating difficulties encountered have been due to dirty plating solutions. The protective value of the plate applied especially is influenced greatly by the cleanliness of the plating solution. It is of this phase of plating that this paper deals.

Source of Suspended Matter

There are two main sources of suspended matter in plating soltuions—from anodes and from plating salts used. More or less of such suspended matter settles to the bottom of the plating tank and as such is not really suspended. It is a potential source, however, as it is easily disturbed by slight agitation.

In a well-regulated or controlled bath anodes contribute the bulk of the sludge or suspended matter. Tests carried out over a considerable period of time showed that about 55 pounds of sludge was obtained from 95-97% anodes to one pound obtained from the commercial plating salts used to keep the solution balanced. A Watts solution was used at 130° F. with a current density of 70-80 amperes per square foot.

Character of Insoluble Matter

The character of the sludge from commercial 95-97% anodes is pretty generally known. It consists chiefly of carbon and iron hydroxide. The character of insoluble matter in commercial nickel salts is not so well known. It consists chiefly of organic matter which forms a gray white floc

when mixed with water. It settles with difficulty, some samples requiring as long as 72 hours to settle all matter visible to the naked eye.

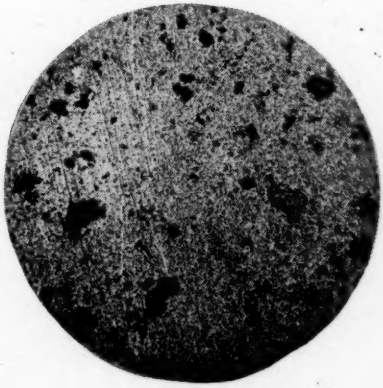
The percentage of insoluble matter in commercial nickel salts is always quite low. Typical analysis of single nickel salts from two manufacturers are given below:

	No. 1.	No. 2. T
Nickel	20.49%	21.8
Iron	0.13	0.06
Copper	0.0	0.0
Zinc	0.0	0.0
Free Acid	0.26	0.09
Insoluble in water	0.05	Trace

Both salts were bought as complying with the specification for single salts as recommended by the Bureau of Standards. Sample No. 1 gave trouble when used in quantities as low as 15 grams per liter (2 oz. per gal.), while the salt represented by sample No. 2 was used in quantities four times as great before there was any indication of defective plate.

Effects of Insoluble Matter

The effect of organic matter in nickel salts is to produce a pitted plate if present in sufficient concentration. As pointed out above, 15 grams per liter of salt No. 1 added to a watt's solution to balance it up caused serious pitting. Sixty grams per liter of salt No. 2 caused only slight pitting.



X 100
Nickel Plate From Dirty Solution
Showing Carbon Particles

X 100
Nickel Plate From
Clean Solution

There are several methods of preventing this class of pitting. Hydrogen peroxide or permanganates may be used to oxidize the organic matter, or the solution may be allowed to "settle out." If it is necessary to use a poor grade nickel salt we have found the best method to be to dissolve it in a separate tank or barrel, "settle it out" over night and then add the clear solution to the plating solution it is desired to balance. The addition of oxidizing agents tends to alter the character of the nickel deposit. Salts of the character of sample No. 2 given above can be used with entire satisfaction with no treatment whatsoever. Our specification for nickel salts calls for not more than a trace of insoluble matter in water.

The effect of the suspended matter present in the plating solution, which is a combination of that from the anodes, nickel salts, dust from the atmosphere, etc., is to produce rough nickel deposits. The roughness depends upon the concentration of the insoluble matter present and may vary from almost smooth to a surface as rough as a rasp.

The suspended matter in the solution in which the test pieces were run was by analysis:

Iron as oxide	43.6%
Nickel	5.0
Silica	2.1

Balance—Water and organic (including Carbon)

The roughness of the deposit was found to be due to particles of carbon deposited on the surface being plated. Parts held horizontally while passing through the solution were much rougher than parts held vertically, indicating that the deposition of carbon was by gravity mainly. The effect of the rough deposit is: 1st—To slow down the buffing operation. Tests made showed that rough deposits from the dirty solution required approximately 70% more time for buffing than the parts from the clean solution. 2nd—More nickel has to be cut off in buffing to a high luster. This is due to the particles of carbon in the plate being removed when buffed, leaving spots of exposed bare metal. 3rd—Salt spray tests run on rough and smooth samples showed that the relatively clean solution produced a plate which withstood the spray four to five times longer than that from the dirty solution.

No attempt has been made in our plant to determine the maximum concentration of insoluble matter in the plating bath for obtaining smooth protective coatings. Continuous filtration is practiced, and, tanks and anodes cleaned periodically. Under these conditions in conveyor type tanks, Watts solution at 130°F and current density of 70-80 amperes per square foot a plate 0.0003" thick is obtained which withstands the salt spray test from two to three eight-hour periods before noticeably rusting.

It is our belief from past experience that many of the failures of nickel plate to protect against rust is due to unclean plating solutions.

BARREL BRASS PLATING

By Mr. E. Coles of Toronto Branch

Brass plating by the barrel method, if I am to judge by the number of papers written on the subject or the questions asked regarding it, is something of which very little can be done. While not attempting to give any standard formulae for this, I will try to point out several features which govern the successful occomplishment of the process; in fact, I do not believe it possible to establish a standard formulae, but believe that by the observance of certain features and making your standard of them, any man who can successfully operate a still brass solution can do the same with barrels.

Temperature, current density, relation of anode surface to cathode, sufficiency of perforations in the container and amount of free cyanide in solution are factors which govern the content or density; also proportion of copper and zinc in solution.

I would say here, and very emphatically, that it is impossible to obtain uniform results as to color without the aid of an ammeter and a thermometer. Of the hydrometer, I do not remember using it since shortly after taking this position, 16 months ago.

To say which of the features I enumerated is the most important to the beginner, would be impossible, as each one is related to the other. Perhaps, however, it would be best to take the relation of anode to cathode and bear in mind general principles of barrel plating as to amount of work

that can be placed into the container to allow a general mixing up, thereby obtaining a uniform exposure. All the anodes that you can jam into the tank are not too many for a plating barrel. For the horizontal type of barrels, not more than half full is a good load, and just sufficient speed to obtain a gentle tumbling of the work. It it is work that is inclined to pack, a few pieces of anything metallic to prevent this packing is good practice.

Now, a still brass solution gives best results when operated at a temperature of about 80 degrees Farenheit; allow a little more in the barrel for the extra resistance. I find that between 85° and 90° is a good temperature to operate. There is a peculiar feature about a mechanical brass solution that is not so noticeable in a still solution, that the solvents must be watched very carefully. There seems to be a balancing point that must be maintained to get proper results. This point is indicated by your ammeter.

When first starting to operate a barrel brass solution find the point on the ammeter where you get best results and see that with very slight variations you maintain it. Should your amperage start to fall add concentrated cyanide solution carefully, a little at a time, till it raises to about the standard point, but watch this falling of amperage that it does not continue for any length of time, otherwise you may go over your free cyanide point, and will get no deposit at all. It seems under the balance (copper deposit) over the balance, no deposit.

The number of perforations or holes in the container have also a very great bearing on the color of the deposit. A container that is all holes would be an ideal one. This is true, of course, of all barrels, but the color in brass makes this more noticeable. The container with insufficient holes will give you a red or an uneven color in spite of everything.

The use of the hydroxide is another point on which extreme caution must be used, so much is good, but over that much causes tarnishing of the deposit much like a piece of brass tarnishes in the air after an insufficient rinsing after swilling in a cleaning solution, and this tarnishing happens so quick that it is almost impossible to prevent it between emptying the load and rinsing off.

Satisfactory deposits can be obtained on such work as trunk hardware and I will give an outline of the methods I am using.

The previously tumbled work is placed direct into the plating barrel, without running through a cleaner or acids, container closed and set in motion. I let it run for a few minutes to clean. This, I find, is sufficient cleaning. Rheostat then closed and ammeter will register considerably higher than standard point for a few seconds; it then falls to standard, and I glance at it occasionally. Should it fall I add cyanide solution and watch ammeter. Should amperage not raise I shut off current for a few minutes for anodes to clear and open up again. I do not wish to convey the impression that this opening and shutting is going on all the time, but it will occur occasionally. After work has plated for a given time I run work from 10 to 30 minutes. Shut off current, raise container and empty onto a stand, turn water onto stand to give a thorough rinsing. Water is cheap and I act accordingly. Place in baskets and pass through hot water and into a perforated tumbling barrel with little sawdust to dry. When dry it only takes a few minutes. I place a little more sawdust than the bulk of work and again tumble to shine, just till the sawdust has sifted out of the barrel, and then dump. Work is inspected and sent to stock room. We do not laquer these, but parts are varnished when the trunk itself is varnished after assembling.

A little here about the solution I am using: it is an old solution, but after a little doctoring I add approximately 2 ozs. of Rochelle salt and about 1½ to ozs. of caustic soda to the gallon and about 2 ozs. of sulphate of ammonia to the gallon. The caustic soda and sulphate of ammonia using both might sound queer, but it must be borne in mind that the caustic is used in combination with the Rochelle salt (Tartrates) to take up the copper salts. A given number of ampere minutes of deposit in this case means a definite amperage for a definite time, not as in a still solution, where, say, 200 amperes for 20 minutes equal 4,00 amperes for an hour 100 amperes for 40 minutes equal the same. If 200 amperes at 6 volts give you the right color, that is what to use. My rheostats are left wide open all the

time and I find that the amperage is practically the same with each batch of work, due naturally to about the same surface exposure.

As in a still brass solution practically all troubles originate from lack of anode corrosion. If you are not sure of your solution, don't start right in to "dope," pull an anode, and if it is "scummed over," clean them all and start up again, watching the ammeter. If it starts to fall rapidly add your cyanide, a little at a time, and you will soon master the solution. Extreme care must be used in adding zinc salts. Indications so often appear that you need it, but again be sure, very little zinc is necessary after solution is made up.

I do not believe in stock solutions, except concentrated solutions of the three main compositions of the solution—copper cyanide, zinc cyanide and sodium cyanide—kept separately for use as needed.

BRANCH NEWS

Detroit Branch

Regular meeting held December 4, at the Detroit Testing Laboratory, 554 Bagley avenue, corner Second avenue, with a full house.

The membership drive is under way and the results are coming in.

The resignation of the Detroit Branch from the Detroit Engineering Society was ordered held over until our absent members were heardd from.

After the minor discussions were disposed of, the all-important subject, "Chromium Plating," started. Some are sending their work to be chromium plated out of town. A number are disappointed as to its color, and that it failed as a rust-proofing agent by itself (no intermediate deposit).

Its good features were, however, commented on, and hopes are entertained by the Detroit bunch to have chromium on a production basis.

Our former member and past president, Walter Allen, entertained us with sage remarks on timely subjects and, of course, included plating from his inexhaustible supply of information.

Another meeting of the same calibre and a motion to hold a banquet will be in order.

As the hour was fast approaching 12 the meeting adjourned.

Toronto Branch

Toronto Branch has a committee planning a social evening for some time in January. Subject for discussion at November meeting was, What is the best condition of anodes with respect to cathodes, to facili-

tate satisfactory and uniform deposits? Mr. Thos. O'Keefe told of his experiments with different arrangement of anodes with relation to cathodes in a silver bath, and illustrated his talk with blackboard drawings.

Mr. John Magill used the blackboard to illustrate his talk on resistance, which was included in the discussion.

The meeting was a very instructive and interesting one, and the attendance was as usual.

Mr. David Ayers of Prescott, Ontario, contributed a very fine article on the subject under discussion. Mr. Ayers cannot appear with us in person, but heldom fails to mail us some good stuff to help the boys. We want more like him.

Indianapolis Branch

Indianapolis Branch held its regular meeting December 12, which was full of enthusiasm and was pronounced by the boys as being like one of the old-timers.

One applicant was elected and two old members reinstated. Our new member, Mr. Pierce, enlivened things by giving a demonstration of the P. H. of nickel solutions. A rising vote of thanks was given Mr. Pierce. Mr. Geo. Barrows read a paper on "Conveyor Work" as he carries it out on stove castings. As enthusiasm had been at low ebb in this branch for some time, I believe that time is past, as prospects are looking brighter for better meetings.

Waterbury Branch

The recent meting of Waterbury Branch, was exceptionally well attended, there being present a number of visiting members from outside Branches. Communications from the executive officers and research committee were read and discussed to some extent. All local members were instructed to look around and see if there were any platers that might be eligible for membership, and if so, to try and get them to affiliate with the Branch. Members were also instructed to use their influence with their employes, and to endeavor to show them the wisdom of contributing to the fund, asked of them by the research committee.

Pickling-cleaning and aluminum finishes were the principal subjects brought up for discussion.

Announcement was made that on January 8th a paper on "Cleaners" would be read by George Hopkins.

A paper on "The Comparison of Ammonium Chloride and Sodium Sulphate Nickel Baths for Barrell Plating" read at our previous meeting, was a subject of much interest, for the members of the local and Bridgeport Branches.

Bridgeport Branch

The December meeting of the Bridgeport Branch was held on the 4th with a good attendance, President Flaherty presiding.

**As it is well established that the regular meeting is always held on the first Friday, this Branch has decided that it is no longer necessary to send out cards to that effect each month.

The fact that we are unable to read any applications for membership at this meeting does not say that some of the members have not been busy. We therefore expect to show some results in the next few months.

We had our old friend, Mr. Charles Buchanan, with us and his visit was indeed timely in view of the different opinions on 99 plus anodes. Mr. Buchanan gave us a very able and interesting outline of the manufacture and use of the anodes, taking the stand that as long as the nodes received the proper heat in melting and the chloride solution is used in operation 99 plus anodes are here to stay.

Chicago Branch

Regular monthly meeting Chicago Branch A. E. S., held December 12, 1925.

Meeting called to order with President F. L. Greenwald presiding, and a very good attendance.

Membership Drive Committee showed some fine work. We elected six and read fourteen new applications.

Chairman Banquet Committee E. Lamoureux reported that everything was set for the coming banquet having engaged a good orchestra, also the Carpenter Sisters, well known Radio entertainers, and several others.

Chairman of Educational program reported having secured several very interesting papers: Subjects, "Bright Brass Plating", by George Hogaboom; "Corrosion", by Erwin Sohn; "Analysis of Boric Acid in Nickel Solution," by Charles Martel, and several other interesting papers.

Balance of evening was turned over to the Librarian who had the following questions in the Box:

Question Box

Question (1) What percent is commercial 24 Karat Gold?

Answer (1) 98 percent pure.

Question (2) What benefit is Carb of Potash to a Silver solution on heavy deposits for burnishing?

Answer (2) It was stated that Carbonates should be kept out, and solution maintained with low cyanide content for heavy deposit.

Cleveland Branch

The Cleveland Branch met at the Hotel Winton for there regular December Business. The meeting was called to order at 8:00 P. M. with Vice President MacCormack presiding. The meting was very interesting with a large attendance. Silas Forcier was elected to membership as an active member. Mr. TerDoest gave a very interesting talk and demonstration with his Block Indicator on testing nickle solutions.

New York Branch

The November meetings of the New York Branch, A. E. S., were well attended. The first of these being an open meeting, featuring Dr. Skowranki of the Raritan Copper Company, demonstrating by aid of film lamp and lecturing on "Copper Refining." Other able speakers addressed the meeting and answered questions most readily were: Mr George Hoagaboon of Newark, N. J., Branch; Mr. Liscomb of Chicago, Ill., Branch; Mr. Wm. Schneider of New York Branch; Mr. Franklyn McStocker of New York Branch: Mr. Wm. Voss of New York Branch.

The following questions were asked and answered:

Question No. 1—Asked by Mr. Downs, New York Branch: How much (tenal) carbolic acid) required to brighten brass solution?

Answer to No. 1—By Mr. George Hoagaboon of Newark: 4 ounces of carbolic acid to 100 gallons of brass solution.

Question No. 2—By non-member: How can alluminum die casting be nickel plated?

Answer to No. 2—By Wm. Voss, New York Branch: Bright dip article and go direct into nickel solution, using full current at first and then reducing to desired. Same answer approved by Mr. Liscomb of Chicago, Ill., who added preliminary emersion in ferrie cloride of iron dip.

Philadelphia Branch

Regular monthly meeting of Philadelphia Branch was held December 4, 1925, and was called to order by the president, George Gehling.

The president thanked the various committees for their hearty cooperation in making the banquet of the branch such a successful affair; also the editor of the REVIEW for his presence at the banquet and the fine editorial.

Mr. A. K. Graham spoke on the plating of zinc and referred the members to the article on this subject in the April, 1925, issue of the MONTHLY REVIEW, by Mr. Thompson of the Bureau of Standards.

St. Louis Branch

St. Louis Branch, A. E. S., held its regular meeting December 1, 1925, at Barr Branch Library. Meeting called to order by President E. J. Musick at 8 P. M., with all officers present. After electing four new active members the meeting was turned over to our Librarian, Mr. Barth, who read the paper on "Combating the Pitting of Nickel Deposited Directly Upon Iron and Steel," by James Wesley, in the November REVIEW, which brought out considerable discussion. From then on our Hon. Hedley J. Richards took over the meeting on 99+90 Nickel Anodes, and our old friend was well under way when the bell rang to quit, so we will have to give him another chance some other time.

Twenty-one members present. Adjourned at 10 P. M., subject to call of the president.

APPLICATIONS FOR MEMBERSHIP

Philadelphia Branch

Thomas Ward, Active .....529 Birch St., Camden, N. J.
Lawrence McLaren, Active .....Marshalton P. O., Delaware

New York Branch

John Mattil, Active .....2163 Gleason Ave., New York, N. Y.
John Morris, Active .....790 Madison St., Brooklyn, N. Y.
A. Dillacana .....1019 E. 212th St., New York, N. Y.
T. H. Johnson, Associate .....23 W. 24th St., New York, N. Y.
Jacob Reingold, Active .....549 Bushwick Ave., Brooklyn, N. Y.
E. C. Bayer Active .....221 West Cortland St., Groton, N. Y.
Charles C. Kromer Active .....New York City, N. Y.

Toronto Branch

H. W. Cannon, Active .....67 Wilson Ave., Toronto
C. G. Colvill, Active .....58½ Boultbee Ave., Toronto
W. E. McGillivray, Active .....Sydney, Cape Breton

ELECTED TO MEMBERSHIP

Indianapolis Branch

H. C. Pierce .....1923 N. Meridan St., Indianapolis, Ind.

New York City Branch

Anthony Dellocana, Active .....1019 East 212th St., New York City
John Mattil, Active .....2163 Gleason Ave., New York City
Arthur J. Duis, Active .....85 Hunter Ave., Long Island City, N. Y.

St. Louis Branch

R. J. Ricket, Active .....4156 Fair Ave., St. Louis, Mo.
Harry Fanter, Active .....4958 Schollmeyer Ave., St. Louis, Mo.
Thomas S. Tracy, Active .....1619 Cass Ave., St. Louis, Mo.
Dominick Lovatto, Active .....7829 Water St., St. Louis, Mo.

Philadelphia Branch

A. K. Graham, Associate.....2524 Girard Ave., Philadelphia
J. F. Green, Active .....201 E. 30th St., Wilmington, Del.
Michael Dinnsha, Active .....5015 Melrose St., Philadelphia, Pa.
Frank G. Wells, Active .....c|o Reading Knob Works, Reading, Pa.
(Formerly of the Reading Branch)
John Medlin .....28 E. Seymour St., Philadelphia, Pa.
Raymond Solivan .....2839 W. Albert St., Philadelphia, Pa.

Detroit Branch

Geo. Timmerman .....2554 Grand River Ave., Detroit, Mich.
Geo. F. Raab., ...2574 Pennsylvania Ave., Detroit, Mich.
Wylie F. Berger .....5787 Fischer Ave., Detroit, Mich.
Wm. J. McDonald .....15411 Kentucky Ave., Detroit, Mich.

Chicago Branch

Clarence H. Brown, Active .....255 Main St., Valparison, Ind.
Cecil M. Knights, Active .....610 Euclid Ave., Glen Ellyn, Ill.
George Glasser, Active .....2432 Queen St., Dubuque, Iowa
Barney H. Ross, Active .....1428 Winnemac Ave., Chicago, Ill.
Roy P. Gauthier, Active .....5346 Berenice Ave., Chicago, Ill.
William Stopper, Active .....2042 North Pripp Ave., Chicago, Ill.
John P. Lamma .....4746 Montana St., Chicago, Ill.

Toledo Branch

J. M. Lee .....526 So. Wayne St., Freemont, Ohio

Newark Branch

Geo. J. Wagner, Active .....1198 Long Ave., Hillside, N. J.
Geo. C. Bartow, Active .....600 William St., Harrison, N. J.

Cleveland Branch

Silas T. Farcier .....1013 E. 148th St., Cleveland

REINSTATED

Philadelphia Branch

D. Allen Metz, Active .....3236 Woodland Ave., Philadelphia
E. F. Clark, Active .....610 Park Ave., Collingswood, N. J.
Frederick Shadell .....225 N. Reading Ave., Boyertown, Pa.
C. F. Harbster .....209 N. 2nd St., Reading, Pa.
L. J. Rathman .....409 S. 5th St., Reading, Pa.
H. D. Strunk .....1548 Perkimon Ave., Reading, Pa.
P. A. Lower, Active .....4045 Marshall St., Philadelphia, Pa.

Toledo Branch

Frank L. Pierce .....c|o Ohio Art Co., Bryan, Ohio

Waterbury Branch

Harold Pierson, Associate .....54 Wildwood Ave., Waterbury, Conn.

Indianapolis Branch

C. H. Humphries .....c|o Metal Protection Corp'n, Indianapolis, Ind.
H. C. Warner .....2424 E. 10th St., Indianapolis, Ind.

APPLICATIONS RECEIVED

Detroit Branch

James Lennox, Active .....5840 Maxwell Ave., Detroit, Mich.
H. Joyorian, Active .....c|o Superior Plating Co., Detroit, Mich.
G. A. Spies, Active .....Marysville, Mich.

Milwaukee Branch

O. W. Kopetski, Active .....1623 Woodrow Ave., Racine, Wis.
Mike Loeppe .....1823 W. 6th St., Racine, Wis.

Chicago Branch

Fred G. Leal, Active .....1805 So. 17th Ave., Maywood, Ill.
George Skazydlewski, Active ....3331 No. Monticello Ave., Chicago, Ill.
James J. Jones, Active.....422 N. Foley Ave., Freeport, Ill.
Gustaf Silbert, Active.....5448 N. Ashland Ave., Chicago, Ill.
Herbert Haake, Active .....3763 Wilton Ave., Chicago, Ill.
Wm. Hasback, Active .....2055 W. Adams St., Chicago, Ill.
Geo. Vlasaty, Active .....1346 So. Tripp Ave., Chicago, Ill.
Peter Young, Active .....6413 No. Clark St., Chicago, Ill.
Jacob Mintz, Active .....3441 West 12th Place, Chicago, Ill.
Albert C. Pramsehiefer, Active .....3434 Melrose St., Chicago, Ill.
John M. Bigalke, Active .....517 Fairfield Ave., Elmhurst, Ill.
James F. Markett, Active .....148 N. 34th Ave., Melrose Park, Ill.
Mark Warren Eichelberger, Assoc. ....7427 So. Shore Drive, Chicago, Ill.

You and Your Friends are Cordially Invited to attend

THE FOURTEENTH ANNUAL BANQUET

of the

CHICAGO BRANCH

of the

AMERICAN ELECTROPLATERS SOCIETY

To be held in the Cameo Room of the Morrison Hotel, Clark and Madison Streets, Chicago, Ill., on Saturday afternoon and evening, January 23, 1926.

TICKETS, $3.50 PER PERSON

An interesting educational session will be held at 3:00 P. M. which will be followed at 7:00 P. M. by a splendid dinner, full of entertainment and concluded by dancing. Do not forget the ladies.

For reservations and further information communicate with the Secretary, Mr. R. M[illegible], 2210 Wilson Avenue, Chicago, Illinois